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Research Paper

Empirical Analysis of the Impact of Exports and Imports on Inflation in Indonesia

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Abstract

This study aims to analyze the impact of exports and imports on inflation in Indonesia. The analysis considers macroeconomic variables such as money supply, interest rates, exchange rates, and foreign exchange reserves during 2014-2023. Studying inflation in Indonesia is crucial because it affects economic stability, purchasing power, and policy effectiveness. The Error Correction Model (ECM) is used, which allows for the analysis of long-term and short-term dynamics. The unit root test for stationery and Johansen's co-integration tests were carried out to examine long-term relationships. The multicollinearity, autocorrelation, and heteroscedasticity tests are applied to the Best Linear Unbiased Estimators (BLUE) assumption. The estimation results indicate that exports significantly affect inflation, whereas imports do not. Foreign exchange reserves have a negative and significant impact, whereas the amount of money in circulation is insignificant. This emphasizes the importance of adaptive monetary policy, a more competitive export strategy, and more flexible management of foreign exchange reserves to maintain inflation stability in Indonesia. Bank Indonesia must consider the persistence of inflation when determining its interest rate policy and controlling liquidity so that its impact on the economy can be more controlled.

Keywords: *international trade, error correction model, inflation*

INTRODUCTION

Economic growth is commonly measured through the increase in per capita income, which indicates economic stability. Every country endeavor to achieve sustained economic growth as it reflects progress in economic development. Ensuring economic stability requires strengthening economic resilience against domestic and international shocks (Bugis et al., 2023). However, economic fluctuations remain a persistent challenge that demands strategic policy responses. An unstable economy can lead to various macroeconomic imbalances, potentially disrupting economic performance (Silaban et al., 2021).

One of the key economic issues is inflation, which refers to a sustained increase in the general price level of goods and services over time. Inflation becomes particularly concerning when persistent price increases occur across multiple sectors, affecting the overall economy. A rise in one or two specific goods or services cannot be classified as inflation unless it triggers widespread price adjustments in other sectors (Anugrah et al., 2019). Inflation plays a crucial role in shaping economic growth, as moderate inflation within an acceptable range is often associated with healthy economic expansion. However, excessive inflation can create instability, especially during economic, social, or political uncertainty (Ningsih & Kristiyanti, 2018).

Theoretically, inflation is driven by two primary mechanisms: demand-pull inflation and cost-push inflation. Demand-pull inflation occurs when aggregate demand exceeds production capacity, increasing price pressure. Conversely, cost-push inflation arises when production costs increase, forcing businesses to raise prices to maintain profitability (Melaku, 2021). Persistently high inflation erodes purchasing power, dampens economic activity, and generates uncertainty, adversely affecting public welfare and investment decisions (Yusman et al., 2021).

To mitigate inflationary pressures, central banks implement monetary policies that maintain price stability while fostering sustainable economic growth. Monetary authorities seek to regulate liquidity and anchor inflation expectations using instruments such as interest rate adjustments, open market operations, and reserve requirements (Juselius & Takáts, 2021). A well-calibrated monetary policy ensures macroeconomic stability and supports long-term economic development.

In Indonesia, inflation has become one of the main focuses studied comprehensively, especially since Joko Widodo took office as President of the Republic of Indonesia in 2014. During his leadership, efforts to control inflation were carried out through the Economic Policy Package Phase I, which was launched in September 2015. This package consists of three main steps: first, increasing the competitiveness of the national industry through deregulation, de-bureaucratization, and legal and business certainty; second, accelerating the implementation of national strategic projects by overcoming various obstacles, including discretion in resolving obstacles and legal protection; and third, encouraging investment in the property sector.

At the same time, Bank Indonesia, as the monetary authority, launched five policy packages to strengthen economic stability. These measures include strengthening inflation control and encouraging the real sector through the coordination of the Inflation Control Team (TPI) and the Regional Inflation Control Team (TPID); maintaining rupiah exchange rate stability by maintaining confidence in the foreign exchange market and the government securities (SBN) market; stabilizing the rupiah exchange rate by changing the reverse auction mechanism of SBN repo and Bank Indonesia Certificates of Deposit (SDBI); managing the balance of foreign exchange supply and demand; and deepening the money market.

Despite extensive studies on inflation in Indonesia, existing research has predominantly focused on monetary factors, such as exchange rates, interest rates, and money supply (Anugrah et al., 2019; Rahma & Soebagio, 2023). However, limited attention has been given to the impact of international trade, particularly exports and imports, on inflation dynamics. This study fills this gap by employing the Error Correction Model (ECM) to analyze both the short- and long-term effects of exports and imports on inflation. Using ECM allows a more comprehensive understanding of inflationary trends by capturing dynamic adjustments over time.

Imports may significantly influence inflation. An increase in imports can directly increase domestic inflation. This occurs because the import increase indicates that the domestic supply capacity cannot meet the existing demand. This condition resulted in a surge in the price of goods. However, on the other hand, when demand adjusts for domestic output levels, inflation tends to decline. Based on data from the Central Statistics Agency (Badan Pusat Statistik, 2023), the period from January 2014 to December 2023 shows an increasing trend in imports. At the beginning of the research period, imports were recorded at 14 million USD, whereas in December 2023, the value reached 19 million USD. The peak of the highest inflation during the 2019-2023 occurred in August 2020. From March 2022 to August 2022, there was a reasonably stable increase in imports. If this systematically increasing import trend continues, the impact on inflation will be more pronounced (Jumhur et al., 2018).

Similar to imports, exports also affect inflation. Exports exceeding domestic demand can trigger a scarcity of goods in the domestic market, ultimately increasing inflation. Data from BPS shows that the period from January 2014 to December 2023 also recorded a significant increase in export value. At the beginning of the period, the export value reached 14 million USD, whereas in December 2023, the value increased to 22 million USD. The most significant export increase occurred in August 2022, with an export value of nearly 28 thousand million USD. From March 2022 to August 2022, there was a reasonably stable increase in exports, but if this trend of increasing exports continues systematically, the impact on inflation will be more pronounced (Jumhur et al., 2018).

The money supply plays a crucial role in inflation dynamics, as explained in the quantity theory of money. According to this theory, an increase in the money supply drives an increase in demand, which ultimately causes prices to rise (Esumanba et al., 2019). In his theory, Irving Fisher states that the money supply has a proportional relationship with prices, assuming that the velocity of money circulation and the volume of goods remain constant (Bordo & Rockoff, 2013). Thus, this theory argues that changes in the money supply will directly impact price changes. For example, if the money supply doubles, the price level will also experience the same increase (Sari & Nurjannah, 2023). However, further research shows that the effectiveness of the quantity theory of money depends on various external factors, such as inflation expectations (Ali & Ibrahim, 2018).

The exchange rate plays a crucial role in an open economy because it affects the trade balance and the price of imported goods, ultimately impacting inflation. The depreciation of the Rupiah exchange rate causes an increase in the price of goods, including raw materials, for companies' production, assuming consumer demand remains constant (Adiyadnya & Swara, 2021). On the other hand, depreciation of the Rupiah due to foreign debt can lower the price of export goods, making them more competitive than products from other countries. This price reduction encourages an increase in export volume and revenue. In addition, purchasing power for imported goods also increases, which contributes to increasing domestic supply and decreasing the price of goods (Chandra & Wahyuningsih, 2021).

Interest rates are a factor that influences investment levels. In addition, interest rates also play a role in controlling inflation by influencing consumer spending and investment, where higher interest rates tend to reduce inflationary pressures by limiting lending activities (Mpofu, 2011). Increasing interest rates generally impact decreasing investment, as explained in Keynes' theory, which states that high interest rates encourage people to save money in banks to get returns so that the amount of money in circulation decreases. Inflation can be suppressed (Rahma & Soebagio, 2023). When the BI Rate rises, credit and deposit interest rates also increase. Increasing deposit interest rates encourages people to save more, ultimately reducing the amount of money in circulation. On the other hand, an increase in credit interest rates increases the cost of capital, so business actors tend to reduce investment, which can slow down economic activity (Langi., 2014). Based on conventional economic theory, high interest rates reduce people's interest in shopping and investing, suppressing demand and helping control inflation (Rahardjo, 2024).

Based on this background, this study aims to analyze the influence of exchange rates, money supply, interest rates, exports, and imports on inflation in Indonesia. This study provides an overview of the influence of each independent variable, namely imports, exports, exchange rates, money supply, interest rates and reserves on inflation in the ten years 2014-2023. In addition, this research can also be the basis for developing economic strategies and policies that are more adaptive and responsive to the dynamics of economic variables such as imports, exports, exchange rates, money supply, interest rates, and foreign exchange reserves in controlling inflation. Therefore, future deflation can be anticipated to be even better.

Studying inflation in Indonesia is essential because of its significant impact on economic stability, purchasing power, and the effectiveness of monetary and fiscal policies. This study addresses a gap in the literature by empirically analyzing the relationship between exports, imports, and inflation in Indonesia, offering a nuanced perspective by using some important macro variables in the analysis. By examining how international trade influences inflation dynamics, this research provides deeper insights for policymakers in designing more effective and stable economic strategies.

The difference between this study and previous studies lies in the focus of the current study. This study focuses on the interaction between inflation and international trade variables: exports and imports. Most previous studies have focused more on monetary variables like interest rates,

exchange rates, and money supply. In contrast, the effect of international trade on inflation has not received much attention. However, this study considers monetary factors when analyzing how exports and imports affect inflation in Indonesia's short- and long-term. Using the error correction model (ECM), this study captures the dynamics of inflation adjustments to changes in international trade and relevant monetary factors. The findings are expected to provide new insights for developing more effective economic policies to control inflation through adaptive international trade strategies and appropriate monetary policies.

LITERATURE REVIEW

Due to its significance in economic analysis and policymaking, inflation has been extensively studied in national and international journals. This literature review categorizes previous studies into key themes to highlight the most striking differences in findings and identify gaps in the existing literature. The goal is to identify the variables used by previous studies that can be considered in the macroeconomic analysis and policymaking process.

The Effect of International Trade on Inflation

Studies have examined the impact of trade factors such as imports and exports on inflation. Ahmed et al. (2018) evaluated the relationship between exports and imports in Pakistan using monthly data from July 2001 to June 2017. They found that imports and exports positively influenced inflation in Pakistan over the long term, with inflation deviations corrected by approximately 1.18% per year. Similarly, Ugoh et al. (2022), analyzing Angola, Nigeria, and South Africa (2001-2020), found that money supply growth and deposit interest rates significantly increased inflation while GDP growth was negatively impacted. Interestingly, exports showed a positive but insignificant impact, while imports and real interest rates were negatively correlated but insignificant.

Effects of Macroeconomic Variables on Inflation

There is a strong theoretical and empirical relationship between the broad money supply, central bank interest rates, exchange rates, and inflation. An increase in the broad money supply tends to drive inflation if not accompanied by sufficient economic growth. Meanwhile, higher interest rates can be used to control inflation through mechanisms such as reducing aggregate demand and strengthening the exchange rate. Thus, central banks, including Bank Indonesia, must carefully balance economic growth and price stability when developing monetary policy.

The government and the central bank also play crucial roles in economic stability through structural reforms, investment climate improvements, deregulation, and infrastructure development. Indonesia's Economic Policy Package I, introduced in September 2015, aimed to boost investment and competitiveness (Kementerian Koordinator Bidang Perekonomian, 2015). Infrastructure development has been a priority for enhancing connectivity and supporting long-term economic growth. On the monetary side, Bank Indonesia has focused on controlling inflation and stabilizing the rupiah exchange rate through various policy instruments, such as the benchmark interest rate (BI-Rate) and foreign exchange market interventions.

During external economic pressures in 2018, Bank Indonesia raised interest rates multiple times to stabilize the rupiah. In 2019, the policy shifted toward an accommodative approach, with interest rate cuts aimed at boosting economic growth. During the COVID-19 pandemic (2020-2021), BI implemented monetary easing by reducing interest rates from 5% to 3.5% and purchasing government bonds to provide liquidity and support economic recovery. 2023, during global economic uncertainty, BI introduced a five-pronged policy mix covering monetary policy, macroprudential policy, payment system policy, financial market deepening, and inclusive and

green finance policy.

Empirical Evidence of Inflation Determinants

Studies have consistently demonstrated that broad money supply growth significantly impacts inflation. If the money supply increases while money circulation and output remain stagnant, prices tend to rise, causing inflation. Empirical studies in developing countries have indicated that excess money supply is frequently associated with higher inflation.

Slamet and Hidayah (2022), Malec et al. (2024) and Rahardjo (2024) explored the impact of exchange rates, interest rates, and money supply on inflation. Rahardjo (2024), using data from 2018-2022, found that exchange rates were not significant in influencing inflation, contrasting with other studies where higher exchange rates correlated with inflation increases (Slamet & Hidayah, 2022; Malec et al., 2024). Malec et al. (2024) further noted that in the short term, inflation is influenced by supply shocks and inflation momentum. In contrast, it is driven by exchange rates and international price fluctuations in the long term.

Other studies highlight regional variations in inflation determinants. For instance, Agusmianata et al. (2018) demonstrated that fiscal policies significantly impact inflation, where government spending reduces disposable income, indirectly affecting the money supply and inflation. Bugis et al. (2023) found that interest rates and the money supply positively affected short—and long-term inflation in North Sumatra. These findings align with those of Tirtosuharto and Adiwilaga (2013), emphasizing regional differences in inflation drivers.

Anugrah et al. (2019) focused on the factors of demand and supply, particularly in the food sector. They found that climate conditions, inflation expectations, and seasonality affected inflation in the short term, whereas in the long term, money supply played a dominant role. In contrast, Rahma and Soebagio (2023), using data from 2005 to 2022, found that money supply and exchange rates did not significantly influence inflation. Instead, they observed that rising interest rates triggered inflation, a finding consistent with the Gibson Paradox.

The Role of Foreign Exchange Reserves in Inflation

Foreign exchange reserves have also been identified as a key determinant of inflation. Kuncoro (2024) argued that while foreign exchange reserves are buffers against external shocks, excessive accumulation can lead to financial instability and inflationary pressures. His study (2005-2020) showed that increasing reserves triggered inflation, with Granger causality tests confirming a one-way causality from reserves to inflation.

Dynamic Interactions Between Money Supply, Interest Rates, and Inflation

The macroeconomic literature has widely studied the interaction between broad money supply, interest rates, and inflation. The broad money supply, which includes cash, deposits, and liquid assets, is a crucial determinant of inflation. An increase in the money supply often leads to inflationary pressures as more money circulates in the economy, increasing demand for goods and services. Studies have found that excess liquidity from expansive monetary policies is a primary factor driving inflation (Ogbonna et al., 2024).

Empirical evidence from developing economies suggests that money supply and market interest rates significantly influence inflation, whereas central bank refinancing rates have a more limited impact (Baba et al., 2024). Conventional economic theory suggests that raising interest rates curbs inflation by making borrowing more expensive and reducing spending and investment. However, the Neo-Fisherian perspective argues that higher nominal interest rates can lead to long-term inflation. This perspective challenges traditional monetary policies, suggesting that higher interest rates do not always lead to lower inflation (Bhat et al., 2023).

Dynamic models have examined the complex relationships among money supply, interest

rates, and inflation. Studies using the Two-Stage Least Squares (2SLS) approach have shown that interest rates significantly influence exchange rates, impacting inflationary trends (Kerbeg et al., 2023). Additionally, fiscal policy and external factors, such as oil prices, are essential in inflation forecasting (Ogbonna et al., 2024).

RESEARCH METHOD

This study attempts to determine how aggregate trade, exports and imports affect inflation using the variables in Table 1. The relationship between trade and inflation is important because these two factors influence economic growth in developing countries (Ahmed et al., 2018). The focus of observation of this study was the administration of Joko Widodo. The data used is monthly from 2014 to 2023, so the number of observations was 120. In more detail, data descriptions, such as variables and time frequencies of data sources, can be found in the following table.

The Error Correction Model (ECM), introduced by Sargan and later developed by Engle and Granger (1987), analyzes short-term dynamics and long-term equilibrium relationships among co-integrated variables. By incorporating an error correction term (ECT), ECM allows researchers to assess how quickly a dependent variable returns to its long-term path after deviations. This makes ECM suitable for studying inflation dynamics because inflation is often persistent and influenced by economic fundamentals such as trade, exchange rates, and monetary factors. However, ECM has several limitations. First, it requires a strong co-integration relationship among variables, meaning the model becomes invalid if no co-integration exists. Second, ECM assumes that the speed of adjustment remains constant over time, which may not hold in the presence of structural breaks or policy changes. Third, the model relies heavily on appropriate lag selection; incorrect lag choices can lead to biased estimates and incorrect inferences. Additionally, ECM primarily captures linear relationships and may fail to account for nonlinear dynamics often present in macroeconomic variables. Finally, multicollinearity and endogeneity among regressors can lead to inefficient parameter estimates, further limiting the model's effectiveness.

Table 1. Variable Description

Variable Name	Description	Frequency	Source
inbi	Inflasi year-on-year	Monthly	Bank Indonesia
ntr	Exchange Rate	Monthly	Bank Indonesia
m2	Broad Money	Monthly	Bank Indonesia
es	Export	Monthly	BPS
imp	Import	Monthly	BPS
reserve	Foreign Exchange Reserve (FX)	Monthly	Bank Indonesia
borate	Interest Rate	Monthly	Bank Indonesia

The stages that must be performed are stationery, long-term estimation, cointegration, and ECM tests (Gujarati & Porter, 2009; Ekananda, 2016). Stationery tests are carried out with the aim of seeing whether the data is stationary or not. If the variable data satisfy the requirements, the test can be performed using the ECM method. In this study, the stationary test was performed using the Augmented Ficky Fuller (ADF). If variables are found to be non-stationary at levels but become stationary at first difference, they are suitable for further co-integration analysis. After that, the regression test is conducted to determine the cointegration test by looking at the stationarity on the residual (error) long-term regression. Whereas, if the residual is stationary at the level then ECM can be performed. The last stage is to conduct an ECM test by adding a residual variable (error)

to the equation (Amhimmid et al., 2021).

This study uses Inflation data plotted by year-on-year consumer price index (CPI) as the dependent variable. In contrast, imports and exports in millions of US dollars act as independent variables in the developed model (Ahmed et al., 2018). In addition, other determinant variables that regress are exchange rates, interest rates, and foreign exchange reserves (Setiartiti and Hapsari, 2019; Amhimmid et al. 2021; Kuncoro, 2024). The analysis process used in this study used a multivariate structure model to test the relationship between each variable. Thus, the initial function for the equation of the model is written as follows:

$$infbi = \alpha + \beta_1 eks_t + \beta_2 imp_t + \beta_n X_t + \varepsilon_t \tag{1}$$

However, over extended periods, economic models risk spurious regression if structural changes in variable relationships are unaccounted for, leading to misleading statistical significance driven by external shocks, policy shifts, or economic crises (Pesaran et al., 2001). Therefore, detecting structural breaks is crucial for maintaining model validity. Methods such as the Chow Test for single breaks and the Bai-Perron Test for multiple breakpoints can identify these changes. When structural breaks are present, incorporating dummy variables ensures that the model accurately reflects economic realities and preserves estimation reliability. Thus, from equation (1), Equation (1) it can be converted into the form of a linear equation by adding a dummy variable to show the long-term equation as follows:

$$infbi_t = \alpha + \beta_1 eks_t + \beta_2 imp_t + \beta_3 m2_t + \beta_4 ntr_t + \beta_5 birate_t + \beta_6 reserve_t \\ + \beta_7 D_t + \varepsilon_t \tag{2}$$

Where $infbi$ is inflation rate, eks is exports, imp is imports, X_t includes other control variables such as $m2$ is the amount of broad money, ntr is the rupiah exchange rate, here the central exchange rate is used, $birate$ is the benchmark interest rate issued by Bank Indonesia and finally is $reserve$ the country's foreign exchange reserves. D_t is a dummy variable to capture potential structural changes in the model. α, β as a parameter (intercept) and slope coefficient, while ε is white noise error.

Once co-integration is confirmed through the stationarity of residuals from the long-run equation, we derive the error correction term (ECT). The residuals from the long-run regression equation serve as the disequilibrium term that captures deviations from long-run equilibrium as follows:

$$ECT_{t-1} = infbi_t - (\beta_1 eks_t + \beta_2 imp_t + \beta_3 m2_t + \beta_4 ntr_t + \beta_5 birate_t \\ + \beta_6 reserve_t + \beta_7 D_t) \tag{3}$$

The ECT represents how much the dependent variable deviates from its long-run equilibrium, and its coefficient reflects the speed of adjustment toward equilibrium. Equation (3) shows the short-term changes in each independent variable. The following equation is included in the difference in the equation; thus, the equation can be written as follows:

$$\Delta infbi_t = \alpha + \beta_1 \Delta exp_t + \beta_2 \Delta imp_t + \beta_3 \Delta m2_t + \beta_4 \Delta ntr_t + \beta_5 \Delta birate_t \\ + \beta_6 \Delta reserve_t + \beta_7 \Delta D_t + \lambda ECT_{t-1} + \varepsilon_t \tag{4}$$

The Error Correction Model (ECM) was used to analyze the short-term dynamics of variables and their adjustment speed toward long-term equilibrium after conducting unit root and

cointegration tests (Hossin & Islam, 2019). To address endogeneity, this study applied the lagged value of the dependent variable as an instrument (Wang & Bellemare, 2019). If cointegration is present, a Vector Error Correction Model (VECM) is employed to capture simultaneous relationships among variables. The VECM links short-term fluctuations with long-term equilibrium by incorporating the equilibrium error term, making it relevant only when a cointegration relationship is confirmed.

FINDINGS AND DISCUSSION

In the first part this will explain the descriptive statistics of the data used in the analysis shown in Table 2.

Table 2. Descriptive Analysis

	INFBI	NTR	M2	IMP	EKS	BIRATE	RESERVE
Mean	3.785583	13930.89	5958986	16112.37	14754.8	5.39375	124429.7
Median	3.34	14065.31	5670877	14578.25	14451	5.25	125933.5
Maximum	8.36	15867.43	8826531	27928.7	22150.6	7.75	146870
Minimum	1.32	11427.05	3643059	9649.5	8438.6	3.5	100240
Std. Dev.	1.743312	996.9751	1476092	4219.047	3126.872	1.40552	12790.25
Skewness	0.798564	-0.51027	0.305912	1.0381	0.441885	0.263646	-0.17132
Kurtosis	2.920695	3.021807	1.894767	3.072785	2.494706	1.817333	1.932181
Jarque-Bera	12.78553	5.209851	7.979344	21.57952	5.181853	8.38369	6.288211
Probability	0.001674	0.073909	0.018506	0.000021	0.074951	0.015118	0.043105
Observations	120	120	120	120	120	120	120

Source: Authors' proceeds.

The results of descriptive statistics show that the average inflation of 3.79 per cent with a standard deviation of 1.74 per cent reflects relatively stable inflation conditions. However, the distribution is skewed to the right (skewness 0.80), indicating several periods of high inflation. The highest inflation rate occurred during the 2014-2023 period, which occurred in December 2014 at 8.34%. The increase in inflation during that period was due to the increase in several expenditure group indices. The rupiah exchange rate against the USD averages 13,930.89 with moderate fluctuations (standard deviation of 996.98) and a slightly skewed distribution to the left (-0.51), reflecting fairly good exchange rate stability. The highest rupiah depreciation against the USD occurred in April 2020. One reason for the weakening of the rupiah currency is the Federal Reserve System's policy of increasing the benchmark interest rate caused by high inflation in the United States, which reached 3.5%.

The average money supply (M2) is IDR 5,959,986 billion, and the data distribution tends to be normal. The highest amount of money supply (M2) occurred in December 2023. The increase in money supply was due to the development of credit distribution and net bills to the Central Government. Meanwhile, import (16,112.37 million USD) and export (14,754.8 million USD) activities showed moderate fluctuations, with imports slightly higher, potentially affecting the trade balance.

Bank Indonesia's policy rate (BI Rate) averaged 5.39 per cent with a slightly skewed distribution to the right (0.26), reflecting adaptation to macroeconomic conditions. Meanwhile, the average foreign exchange reserves of 124,429.7 million USD showed strong economic stability, with minor fluctuations (standard deviation of 12,790.25). These data indicate a generally stable

economy but require attention to global risks and trade imbalances.

Table 3. Unit Root for Stationary Test

Variable	I(0)		Conclusion	I(1)		Conclusion
	t-stat.	Prob.		t-stat.	Prob.	
ADF-Fisher Chi-square	11.7056	0.6299	Not Stationary	459.103	0.0000	Stationary
PP-Fisher Chi-square	20.9504	0.1029	Not Stationary	404.238	0.0000	Stationary

Source: Authors' proceeds.

The unit root test results in Table 3 indicate that all tested variables exhibit a unit root at level (I(0)), but they become stationary after the first differencing (I(1)). Based on these results, it can be concluded that all variables in the study have an integration order of one (I(1)), meaning that they only become stationary after the first differencing. This suggests that running a regression using level data may lead to spurious regression, making it necessary to use first-differenced data or apply models that account for long-term relationships, such as the Error Correction Model (ECM) or the Vector Error Correction Model (VECM), if cointegration exists among the variables.

Table 4. Johansen Co-integration Test

Hypothesized		Trace Statistic	0.05	Prob.**
No. of CE(s)	Eigenvalue		Critical Value	
None *	0.357978	162.8487	125.6154	0.0000
At most 1 *	0.340193	112.3315	95.75366	0.0022
At most 2	0.199833	64.92950	69.81889	0.1154
At most 3	0.189003	39.51498	47.85613	0.2403

Source: Authors' proceeds.

The test results confirmed the presence of two co-integrating equations in the system (Table 4). This suggests that the variables share a long-term equilibrium relationship, meaning that they tend to move together over time. The presence of co-integration implies that any short-term deviation from equilibrium will be corrected over time, making these models essential for capturing both short-run and long-run relationships among variables. Given these findings, an Error Correction Model (ECM) or a Vector Error Correction Model (VECM) would be appropriate to analyze how short-term dynamics adjust toward long-term equilibrium. However, deviations may occur in the short term due to external shocks or market fluctuations.

Long-Run Analysis

Table 5 presents the results of the OLS estimation. The test was carried out by examining how the independent variable affected the dependent variable (inflation). To obtain robust results, multiple break analysis is implemented. The Bai-Perron test is a robust method for detecting multiple structural breaks in time series data (Hwang & Shin, 2017). This test helps identify the exact break dates, which can then be used to create dummy variables representing different regimes. The test results detected breaks in three regimes: November 2015 (2015M11), June 2019 (2019M06), and May 2022 (2022M05).

The results of the OLS and OLS with structural break regression indicate that exports (EKS) have a positive and significant relationship with the dependent variable, suggesting that an increase in exports contributes to economic growth or exchange rate stability. This finding aligns with

international trade theory, which states that exports drive aggregate demand and increase foreign exchange reserves (Obstfeld, 2014). Conversely, imports (IMP) exhibit a negative and significant relationship in the OLS model but become insignificant after accounting for structural changes. This suggests that under normal conditions, dependence on imports may weaken the domestic sector; however, under certain circumstances, its impact may not be substantial, depending on the economic policies implemented (Todaro & Smith, 2020).

Table 5. Long-run estimation of ordinary least squares with structural break

Variables	OLS	OLS with Structural Break
EKS	0.000418***	0.000231***
	(5.739312)	(3.386649)
IMP	-0.000206***	-9.67E-05
	(-2.964753)	(-1.640328)
M2	-8.23E-07***	-1.43E-06***
	(-2.567263)	(-3.634167)
NTR	8.48E-05	0.000467**
	(0.369414)	(2.326608)
BIRATE	0.833902***	0.134050
	(7.541095)	(0.982085)
RESERVE	6.84E-07	3.42E-06
	(0.029426)	(0.163307)
2015M11		-1.867870***
		(-4.541876)
2019M06		0.237742
		(0.666313)
2022M05		2.690989***
		(6.447320)
C	-0.748451	3.326618
	(-0.175636)	(0.914033)
R-squared	0.723450	0.822743
Adj. R-squared	0.708635	0.808107
Prob(F-statistic)	0.000000	0.000000

Source: Authors' proceeds.

Note:
The paranthesis represents the t-statistics. ***,**,* indicate significance levels of 1%, 5%, and 10%, respectively.

Furthermore, the money supply (M2) has a negative and significant relationship with the dependent variable in both models, indicating that an increase in the money supply may pressure economic stability, for instance, through inflation or currency depreciation. This finding is consistent with the quantity theory of money proposed by Friedman (1970), which states that an excessive increase in the money supply, not accompanied by output growth, leads to rising prices. In the context of Indonesia's economic policy, Bank Indonesia (BI) often implements contractionary monetary policies, such as raising interest rates and controlling liquidity, to curb inflation and maintain the stability of the rupiah.

The interest rate (BIRATE), which is highly significant in the ordinary least squares (OLS)

model but insignificant in the structural break model, suggests the presence of Gibson's Paradox, wherein real interest rates and inflation tend to move in the same direction over the long term. However, in this model, their relationship becomes insignificant after considering structural factors (Taylor, 1993). Bank Indonesia's economic policy often addresses this phenomenon through a combination of interest rate adjustments and market interventions, such as twist or open market operations, to control inflation without hampering economic growth.

The impact of structural changes in the Indonesian economy is also evident in the significance of dummy variables (D2015M11 and D2022M05), indicating that crucial events, such as new policy implementations by Bank Indonesia since 2015 and pandemic in 2020-2021, influenced economic dynamics during those periods. The structural break model has a higher R-squared value (0.823), suggesting that structural factors play a crucial role in shaping economic stability. Therefore, flexible and responsive economic policies, such as BI's policy packages in adjusting interest rates, foreign exchange interventions, and capital flow controls, are essential to maintaining a balance between economic growth and macroeconomic stability.

Short-Run Analysis

Short-term analysis is characterized by an error correction value (ECT) with negative and significant signs. This value was tested for both the root unit and its co-integration. Table 6 presents the results of the analysis using the co-integration of the first difference. In this condition, the lag of the dependent variable is used as an instrument to overcome the endogeneity of the independent variable.

The results indicate that exports (ΔEKS) have a positive and significant impact on the dependent variable, with a stronger effect after accounting for structural changes. Conversely, imports (ΔIMP) and money supply (ΔM2) show no significant relationship, suggesting that changes in these variables do not statistically influence the dependent variable. Foreign exchange reserves (ΔRESERVE) have a negative and significant effect, implying that an increase in reserves tends to suppress the dependent variable, likely due to monetary interventions.

The most significant variable is lagged inflation (ΔINFBI(-1)), which has a highly significant positive coefficient at the 1% level, indicating that past inflationary pressure has persistent effects on the economy. Additionally, the Error Correction Term (ECT(-1)) is negative and highly significant, suggesting a long-term adjustment mechanism that operates more rapidly after accounting for structural changes.

The dummy variables representing structural shifts in 2015, 2019, and 2022 are insignificant, indicating that economic events during these periods did not exert a substantial short-term impact on the dependent variable. Although the R-squared values in this model are relatively around 26-29% for both models, the very small Prob(F-statistic) confirms the overall significance of the model in explaining the relationship between independent and dependent variables. Thus, exports, past inflation, and long-term equilibrium mechanisms play key roles in shaping the analyzed economic dynamics.

This ECM model uses first-differenced variables (Δ), which generally reduce multicollinearity. Because differencing removes trends, the correlation between explanatory variables often decreases, making multicollinearity a less pressing concern (Enders, 2014). Given that the R-squared values are relatively low (25-29%), severe multicollinearity is unlikely because high multicollinearity usually inflates R-squared without improving predictive power. The absence of unexpectedly high R-squared values suggests that collinearity may not be a significant issue (Gujarati & Porter, 2009).

Table 6. Short-run estimation Error Correction Model with structural break

Variables	OLS	OLS with Structural Break
ΔEKS	7.81E-05*	0.000100**
	(1.968747)	(2.449441)
ΔIMP	-3.70E-05	-3.39E-05
	(-1.179298)	(-1.085498)
ΔM2	-5.62E-07	-6.26E-07
	(-1.046227)	(-1.160779)
ΔNTR	1.69E-05	5.24E-05
	(0.097114)	(0.299956)
ΔBIRATE	0.314264	-0.094005
	(1.335623)	(-0.370227)
ΔRESERVE	-4.16E-05**	-3.99E-05***
	(-2.419734)	(-2.325871)
ΔINFBI(-1)	0.311826***	1.254303***
	(3.616924)	(5.638173)
ECT(-1)	-0.234964***	-1.228080***
	(-4.659888)	(-5.023572)
2015M11		-0.166024
		(-1.248340)
2019M06		0.015687
		(0.145274)
2022M05		0.075801
		(0.516013)
C	0.008510	3.326618
	(0.171564)	
R-squared	0.259677	0.286098
Adj. R-squared	0.204838	0.211308
Prob(F-statistic)	0.000053	0.000122

Source: Authors' proceeds.

Note:
The paranthesis represents the t-statistics.. ***,**,* indicate significance levels of 1%, 5%, and 10%, respectively.

Structural Stability and Economic Policy Implications

The CUSUM and CUSUMSQ tests assess the structural stability of the estimated model, ensuring that the relationships between economic variables remain consistent over time. The results indicate that both test statistics remain within the 5% significance boundaries, confirming that no structural instability or significant parameter shifts occurred during the study period. This implies that the estimated coefficients are robust and reliable for policymaking.
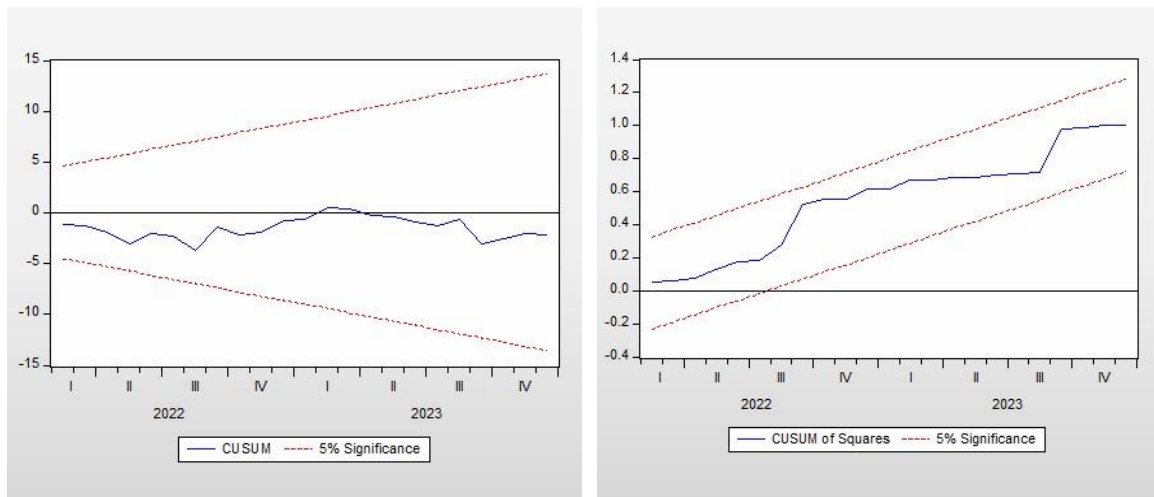
Figure 1. Plots of the CUSUM and CUSUM of the Square Tests

From an economic policy perspective, model stability is crucial for designing effective and predictable policy interventions. In the context of monetary and fiscal policy, structural stability suggests that the transmission mechanisms of policy tools—such as interest rate adjustments, exchange rate interventions, and money supply management—remain effective over time. If the model were unstable, it would indicate potential structural changes in the economy, requiring policymakers to reassess their strategies.

The stability of the model also supports macroeconomic forecasting and long-term planning because it implies that historical relationships between key economic indicators persist. This is particularly important for central banks, such as Bank Indonesia, in maintaining price stability and managing inflation expectations. Given that the estimated model does not exhibit significant parameter shifts, policymakers can rely on it to develop strategies that ensure economic stability and sustainable growth. In summary, the structural stability of the model, as confirmed by the CUSUM and CUSUMSQ tests, reinforces the reliability of economic estimates.

CONCLUSIONS

The conclusions from the long-term and short-term analysis using the error correction model, considering structural breaks, indicate that exports have a significant impact on inflation. In contrast, imports and money supply are not significant. Foreign exchange reserves have a negative and significant effect, reinforcing the role of monetary policy in economic stabilization. Past inflation has a significant effect, reflecting inflation persistence, whereas the negative and significant Error Correction Term (ECT(-1)) coefficient indicates a strong long-term adjustment mechanism. The CUSUM and CUSUMSQ stability tests confirmed that the model remained stable throughout the study period.

Monetary policy should consider the impact of past inflation when controlling interest rates and liquidity to remain effective. Enhancing export competitiveness should be a priority while managing foreign exchange reserves, which must be more flexible to avoid excessive pressure on other economic variables. The insignificance of imports and money supply suggests exploring additional factors, such as fiscal policy and exchange rates, in future analyses. Furthermore, although the model was tested with structural breaks, employing non-linear or machine-learning approaches could improve the estimation accuracy.

LIMITATION & FURTHER RESEARCH

This study is limited by its assumption of a linear relationship between exports, imports, and

inflation, which may not fully capture complex economic dynamics. It excludes external factors such as global commodity prices and fiscal policies influencing inflation. Additionally, the data period may be insufficient to ref lect long-term trends, and reliance on a linear model may overlook nonlinear and asymmetric effects, especially during economic crises or policy shifts. Therefore, future research should explore alternative methods such as the Vector Error Correction Model, Threshold ECM, NARDL, or machine learning approaches to improve accuracy and incorporate broader macroeconomic variables.

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